

# Los Alamos in Space



Los Alamos has strong satellite and space-related programs, initially tied to the Nuclear Nonproliferation mission, with 40 years of work in space-based detection of nuclear detonations and understanding other signals received by the Laboratory's space-based sensors.

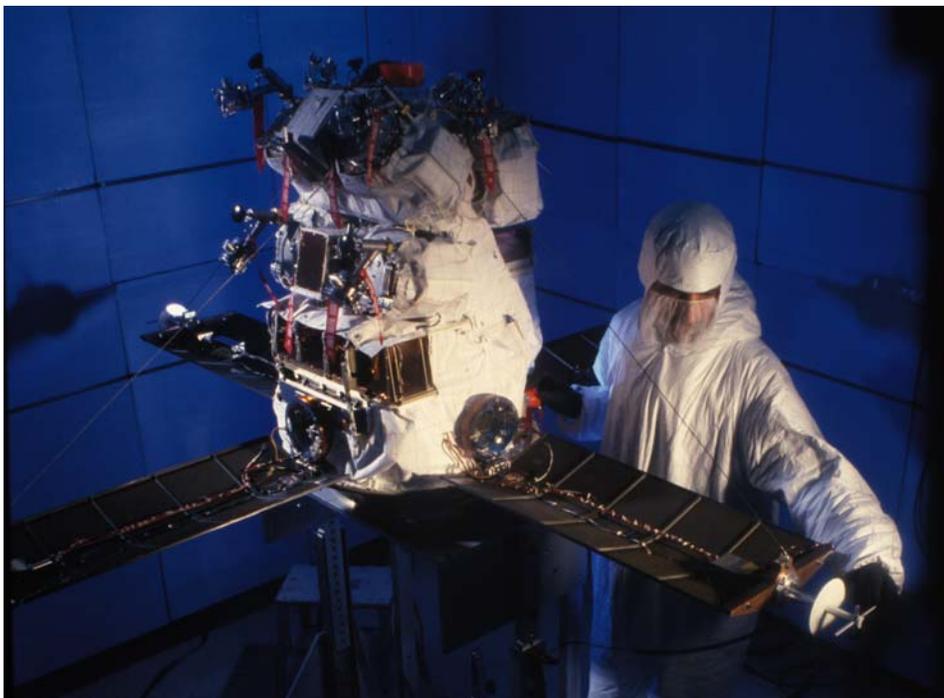
The laboratory hosts more than 100 NASA-sponsored space projects, coordinated through the Los Alamos Center for Space Science and Exploration (CSSE), formed in 1999. Herbert O. Funsten is program manager for the center. NASA has sponsored such civilian space programs at Los Alamos since 1969. Funding for these space science projects has increased from approximately \$3 million a few years ago to a current level of approximately \$25 million.

A few space-related facts about Los Alamos work:

- Los Alamos traces its heritage in space to the Vela program, which used spaced-based nuclear detonation sensors to verify the 1963 Limited Test Ban Treaty. That mission continues today, having successfully launched more than 70 instruments supporting this program.
- Los Alamos has a neutron spectrometer on NASA's Mars Odyssey, and

laboratory scientists have been generating and analyzing detailed water and carbon dioxide maps to understand the Mars climate, both past and present.

- Before the Odyssey mission, Los Alamos neutron and gamma-ray spectrometers flew aboard the Lunar Prospector, mapping the elemental composition of the Moon and revealing ice at the moon's poles that had hitherto only been a matter of speculation.



**The Array of Low Energy X-Ray Imaging Sensors (ALEXIS) is one of America's first modern mini-satellites. The 10-year-old satellite's mission is four-fold: to survey and map the diffuse soft X-ray component of the sky; to look at known bright extreme ultraviolet sources; to search for transient objects such as gamma ray burst events and to study stellar flares. The satellite is operated from an automated ground station at Los Alamos**

- Both Mars Exploration Rovers, Spirit and Opportunity, have Los Alamos-made radioisotope heater and energy units that were fabricated on-site by teams from the Materials Science Division.
- Los Alamos has done extensive work in potential nuclear propulsion and power systems for space, using heat pipe technology. Laboratory efforts are an important part of NASA's Jupiter Icy Moons Orbiter mission, part of the Prometheus project, the agency's next-generation nuclear power & propulsion program.
- Laboratory expertise evolves from projects such the ALEXIS and FORTE satellites (still in orbit capturing data on how signals from lightning are similar and yet different from nuclear detonations). Jointly with Sandia National Laboratories, Los Alamos flies the Multispectral Thermal Imager, an experimental mission for high spatial resolution imaging of ground temperatures and chemical plumes in support of its nonproliferation mission.
- The laboratory is also involved in NASA's Genesis, located between Earth and the sun, gathering solar wind particles to return to Earth next year for analysis.
- Another key collaborative research project is the MIT-led satellite, HETE, the High Energy Transient Explorer, which looks and records for gamma ray bursts, the most powerful energetic events in the universe. Los Alamos is a collaborator in the SWIFT mission that will be launched in 2004 and will record gamma ray bursts with at higher speed and with greater resolution.
- Los Alamos researchers discovered the initial existence of gamma ray bursts, in 1964, in the course of analyzing data from the Vela treaty verification satellites.
- Los Alamos has a vigorous program in solar wind physics, with instruments on NASA's ACE and Ulysses missions. The laboratory's efforts focus on

understanding coronal mass ejections, enormous energetic plasma plumes emitted by the Sun that are the cause of geomagnetic storms at Earth.

- Los Alamos additionally has a mass spectrometer on NASA's Cassini mission to Saturn that will study the planet's space environment and its complex interactions with its moons.
- Los Alamos has satellite-construction facilities, instrumentation development and data analysis expertise, and advanced computer-aided design capabilities for satellite
- Various laboratory-developed sensors for detection of X-rays, gamma ray and neutron signals and for measuring the satellite space environment fly aboard the GPS and defense system spacecraft.
- Teams at Los Alamos provide the plutonium fuel for radioisotope thermoelectric generators, the energy sources for satellites and deep-space missions, with a significant facility devoted to building these power supplies.
- In addition, our work in space weather analysis is essential to understanding the conditions under which spacecraft and astronauts must function.
- Current NASA astronauts John Pettit and John Phillips are former Los Alamos scientists.

## **Selected News Releases on the Subject of Los Alamos and Space Research**

### **Odyssey orbiter studies Mars' changing weather and climate**

Mars may be going through a period of climate change, new findings from NASA's Mars Odyssey orbiter suggest. See full text of release at <http://www.lanl.gov/orgs/pa/newsbulletin/2003/12/09/text02.shtml>

### **Los Alamos releases new maps of Mars water**

"Breathtaking" new maps of likely sites of water on Mars showcase their association with geologic features such as Vallis Marineris, the largest canyon in the solar system. The maps detail the distribution of water-equivalent hydrogen as revealed by Los Alamos-developed instruments aboard NASA's Mars Odyssey spacecraft. See full text of release at <http://www.lanl.gov/worldview/news/releases/archive/03-101.shtml>. Full-color, high-resolution Mars water maps are available at: <http://www.lanl.gov/worldview/news/photos/mars.shtml>

### **Los Alamos hosts gamma-ray burst anniversary conference**

Scientists from around the world are convening this week to debate and share their latest research at the Gamma-Ray Burst 2003 Symposium in Santa Fe, Sept. 9 - 12, 2003. Los Alamos is sponsoring the symposium, the largest of its type to date. See full text of release at: <http://www.lanl.gov/worldview/news/releases/archive/03-123.shtml>

### **XMM-Newton satellite uncovers diffuse X-ray emission and the first accreting X-ray pulsar in Andromeda Galaxy**

In the most sensitive X-ray survey of our neighboring galaxy, Andromeda (M31), the X-ray Multi-Mirror satellite observatory (XMM-Newton) has uncovered hundreds of X-ray sources and provided new insights into the nature of the interstellar medium in the spiral arms of our own galaxy as well as those of Andromeda. An international team of scientists led by researchers at Los Alamos discovered information relating to two key types of X-ray sources. See full text of release at: <http://www.lanl.gov/worldview/news/releases/archive/03-069.shtml>

### **GENESIS' probe's first year a success**

As scientists at Los Alamos National Laboratory begin analysis of first-year data from the solar wind probe GENESIS they have determined the spacecraft is working so well that they are considering possibilities for research beyond the planned 2004 mission completion date. Three of GENESIS' instruments were designed and built at Los Alamos. See full text of release at: <http://www.lanl.gov/worldview/news/releases/archive/02-130.shtml>

### **Los Alamos spectrometers part of "Cluster" mission**

Imaging spectrometers developed at the U.S. Department of Energy's Los Alamos National Laboratory are among the science tools aboard the new, four-satellite Cluster II mission. <http://www.lanl.gov/worldview/news/releases/archive/00-107.shtml>



Los Alamos National Laboratory is operated by the University of California for the U.S. Department of Energy's National Nuclear Security Administration